A preliminary investigation of hoof circumferential changes of riding school horses with an increase in workload

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INTRODUCTION: The equine hoof is a resilient and pliable smart structure that over time has adapted to withstand the demands of evolution and domestication. The hoof is one of the main structures involved in the absorption of forces whilst the horse is working. If the hoof becomes compromised, further limb structures will be required to compensate, increasing their vulnerability and potentially resulting in lameness (O'Grady, 2003). The dynamic structure of the horse's hoof is put under extensive strains through loading during locomotion (Pollitt, 2004) and adjusts to the loading forces through a change in its conformation (Kroekenstoel, et al. 2006). Changes to the circumference of the coronet band have been documented in racehorses between period of rest and training with the circumference decreasing as workload increased and reverting during a decrease in workload (Decurnex, Anderson and Davies 2009). The aim of the this study was to determine whether a change in circumferential hoof parameters would be observed within a population of non-racing horses with an increase in workload.

Figure 1: Tape measure positioning (Decurnex *et al.*, 2009)

METHOD: Using an observational, cohort study design, hoof base circumference (HB) and coronet band circumference (CB) measures were collected via tape measure from 32 shod (all, n=17; shod front only, n=12) and unshod (n=3) riding school horses (Fig. 1).

Measurements were collected at three 5 week intervals (DC1-3) between September and December 2015. Shod forefeet were further sub-grouped into those with toe-clips (n=16) and those with side-clips (n=9).

Workload intensity increased from low in September to medium-high by December. Wilcoxon's matched-pairs determined circumferential differences between left-right hooves for each DC ($p<0.05$); Kruskal-wallis analyses with post-hoc and Bonferroni adjustment ($P\leq0.02$) examined differences between DC.

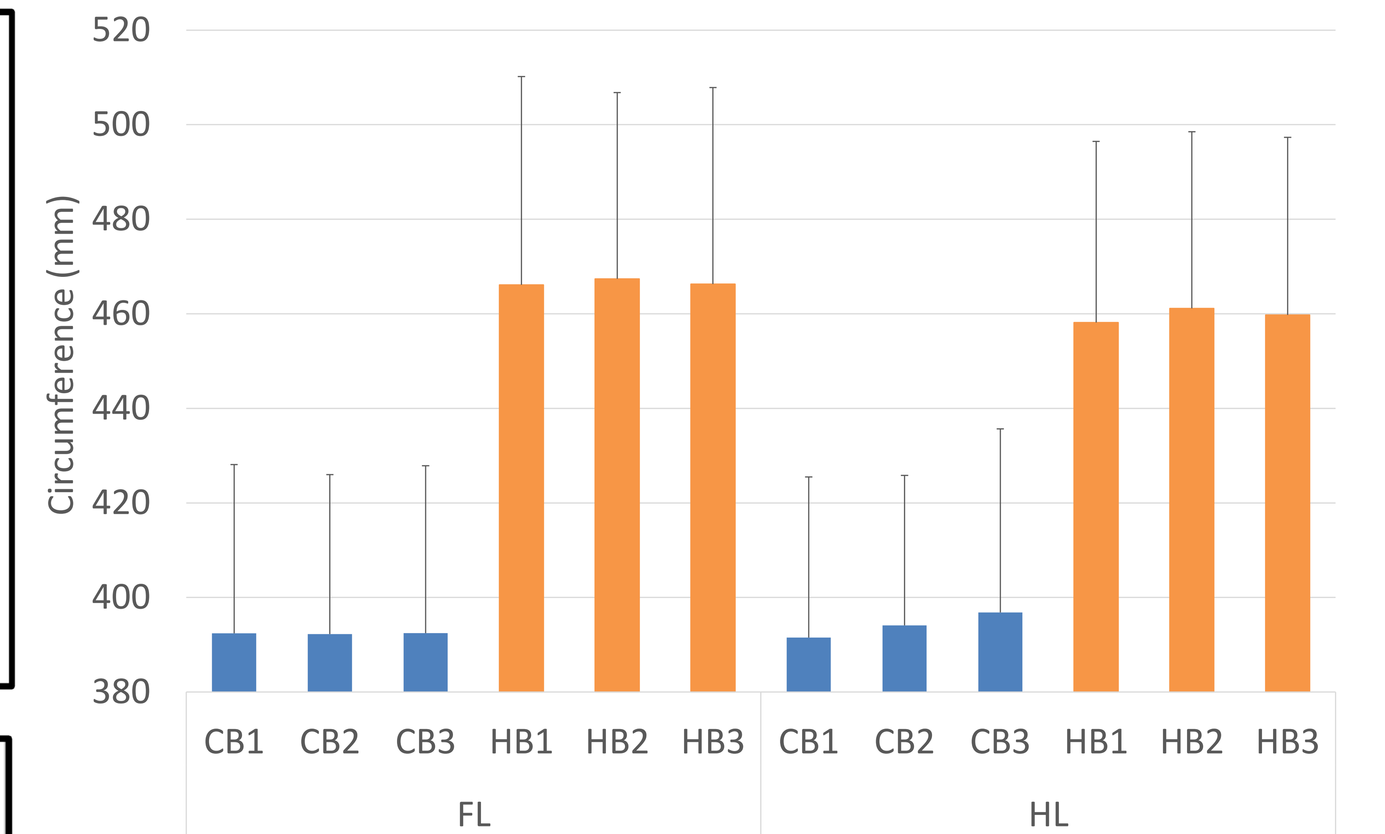

Figure 2: CB and HB measurements changes across all three data points

RESULTS: CB measurements of the forelimb were significantly larger for the right than the left foot at DC3 ($p\leq0.05$). Right side measurements were also larger in the hindlimb for both HB and CB at all data collection points (DC1 $p\leq0.05$; DC2 $p\leq0.05$; DC3 $p\leq0.001$). CB differed significantly between DC1 (389.8mm) and DC2 (392.1mm) ($p\leq0.02$) (Fig. 2).

All variables, except asymmetry, differed between forelimb subgroups; asymmetry only differed at DC1 where CB was significantly lower ($p\leq0.02$) for horses with toe-clips compared to side-clips (Fig 3.). Mean hind CB in shod feet increased significantly ($p\leq0.02$) between DC1-DC2.

Routine management meant some horses had hind shoes removed between DC2-DC3; these individuals demonstrated an increase in right CB at DC3; reflecting by a significant increase ($p\leq0.02$) in mean CB between DC1-DC3.

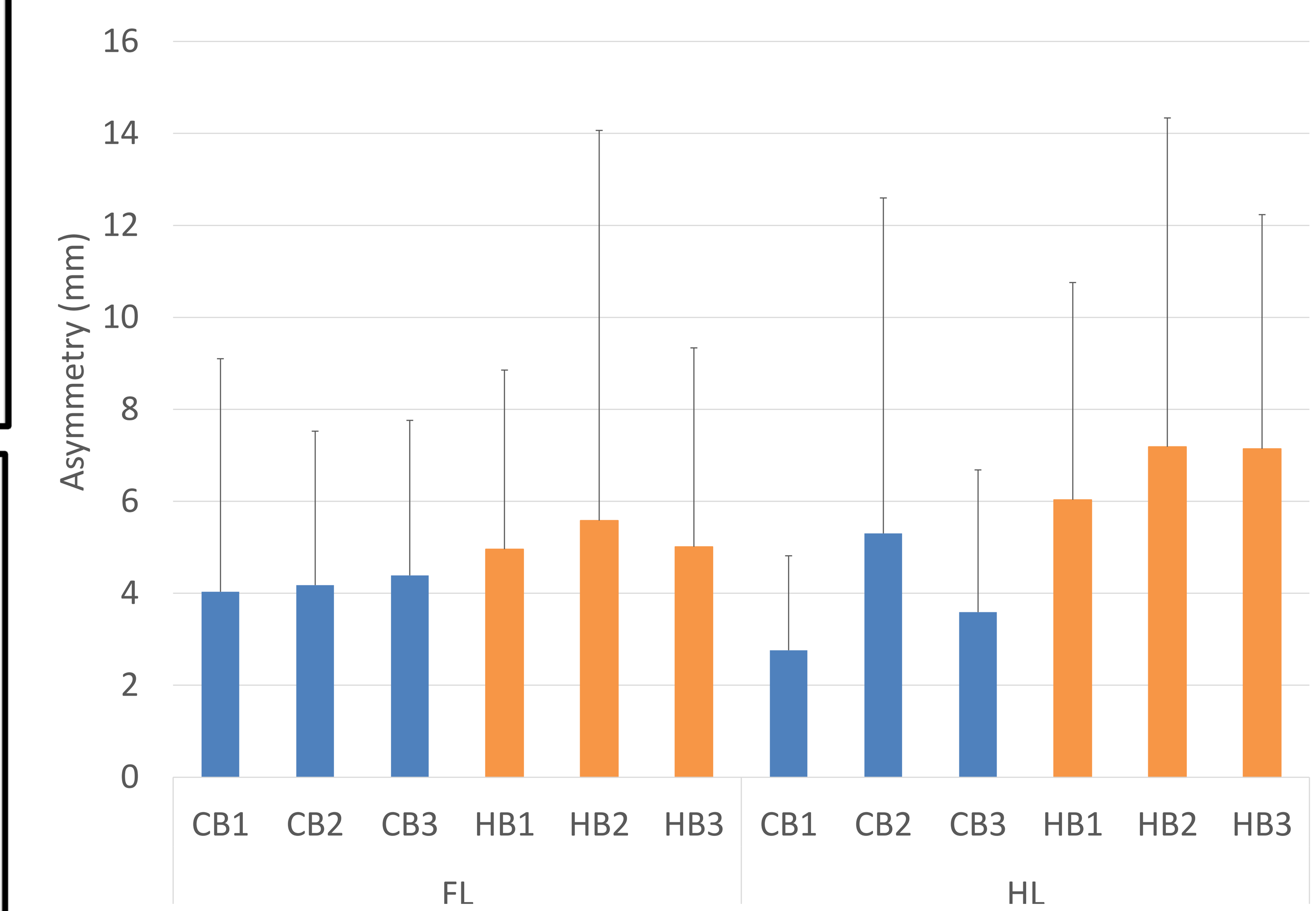

Figure 3: CB and HB asymmetry changes across all three data points

CONCLUSIONS: Riding school horses demonstrated significant changes in hoof conformation related to an increase in the coronet band circumference, in contrast to findings reported in racehorses. The difference found is likely to be due to discipline related exogenous stressors. Concussive forces on the limbs of the riding school horses would be considered of a lesser magnitude, but longer duration, than those of racehorses. Moreover, the orientation of the loading on the limbs would result in variations in concussive forces impacting the coronet band. Racehorses predominantly load the bulbs of the heels due to the landing position of the foot in gallop, such concentration of force could potentially result in retardation of growth. Riding school horses' work in a combination of walk, trot and canter including changes in orientation, and therefore experience greater variation in loading across the foot and consequentially through the coronet band potentially having a stimulatory rather retardation effect.

Little change between DC points was reported within forelimb subgroups between shod and unshod horses. However, significant differences were observed between subgroups for all reported variables except mean asymmetry. Hindlimb the CB significantly increased between the first two DC points but not at the third; this lack of continuation is likely due to a small number of horses having their hind shoes removed following DC2; thus the hooves would have altered in their response to loading. As such, significant differences between values for shod and unshod hooves indicate variation in foot conformation associated not only with the use of shoes, but also with the type of clip used when considering the front feet.

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